Space Weather Technical Forecast

Issued on Sunday 30 March 2025 at 00:36 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Increased Chance of Minor/Moderate (R1/R2) radio blackouts. Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity recorded at GOES16 and 18 rose to Moderate in the period, with a M1.4 at 29/2138 UTC and M1.9 at 29/2259 UTC. The first M-class flare may be associated with a CME, from the centre disc close to AR4043, pending imagery being available for analysis. If this is the case, this has the potential to be Earth-directed. There were no other potentially Earth-directed events noted.

There are six active regions on the Earth-facing disc. The newly numbered AR4048 on the southeast limb, appears to be a larger spot region. This region may have some complexity to it once fully visible on the disc. There is a large amount of magnetic looping and the region has been associated with previous X-class flare activity and a recent M-class flare with associated CME. Most regions have developed during this period but remain magnetically simple. Most notable active regions are AR4046 with continued leading spot development and AR4043 with growth of trailing spots.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by ACE at L1, showed a gradual waning of a fast wind emanating from CH25/+.

The solar wind speed fell from initial Strong levels, around 620 km/s, to Slightly Elevated levels, currently around 460 km/s. The solar wind density was below average throughout. The Interplanetary Magnetic Field, Bt, was at weak levels, around 5 nT. The north-south component, Bz, varied between +/-4 nT. The phi angle was predominantly positive (away from the Sun) throughout. The net result of the above solar wind measures was for Quiet to Unsettled (Kp1-3) geomagnetic activity.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 was at Background.

High energy electron flux (greater than 2 MeV) at GEO is High, peaking at 2970pfu at 29/1625UTC. The 24-hour integrated fluence exceeded Active at 29/1500 UTC, with the observed 24-hour integrated fluence 1.28e8pfu at 29/2359UTC.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: M-class activity has been increased slightly and is now considered 'Likely'. X class activity have been revised downwards slightly due to lack of activity in this period but there continues to be a 'Slight chance'. No significant regions depart the disc.

Solar Wind / Geomagnetic Activity: There is a potential for an Earth-directed CME, associated with an M-class flare from the centre disc close to AR4043 at 29/2138 UTC, pending imagery being available for analysis. The current fast wind from CH25/+ is waning, geomagnetic activity is expected to be generally Quiet to Unsettled with isolated Active intervals. There is then a possible minor resurgence due on 01 April from a comparatively minor coronal hole (unnumbered), with a further Slight Chance of G1.

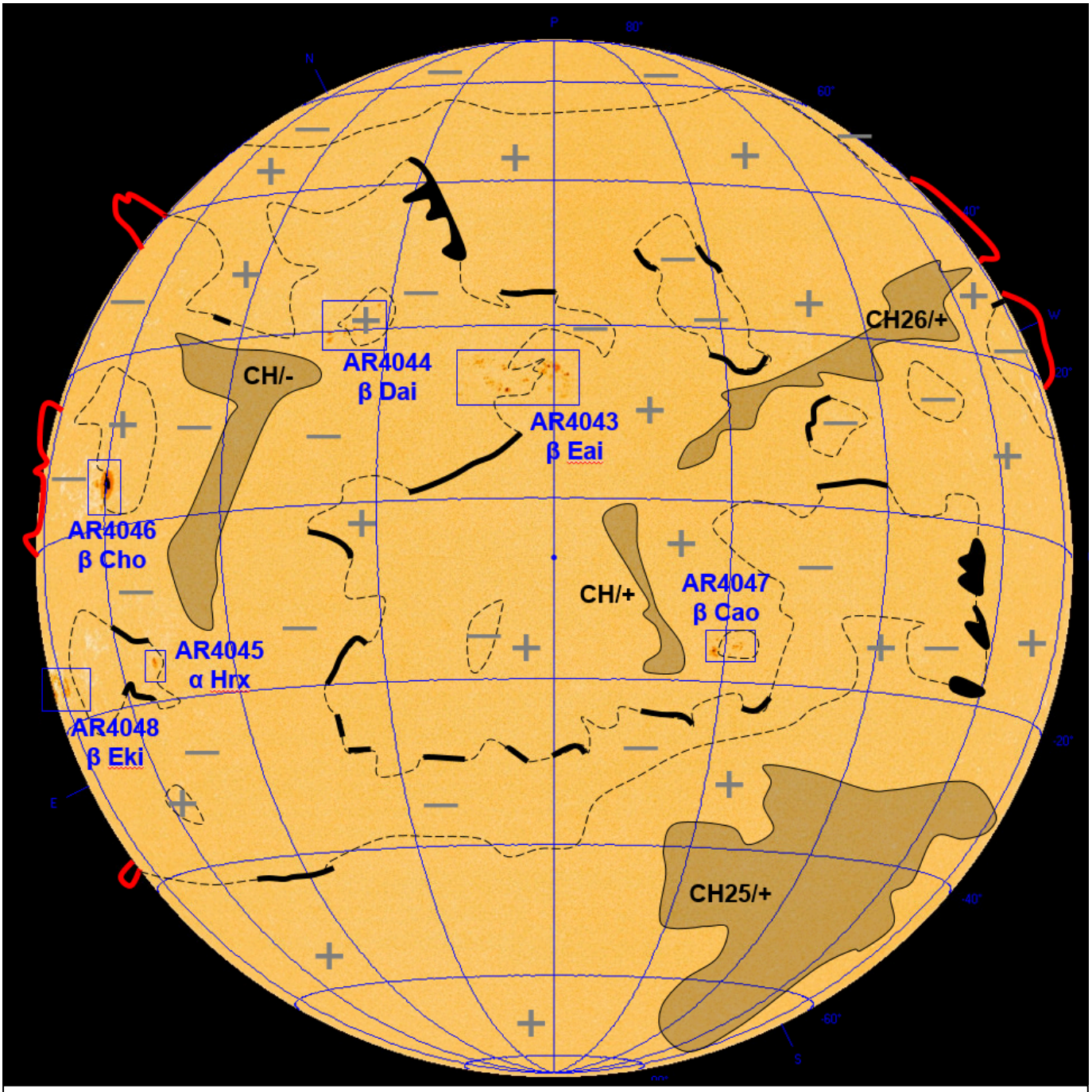
Energetic Particles / Solar Radiation: High energy proton flux is expected to be at Background levels, with a negligible chance of enhancement from any larger flares given their likely far eastward emission locations.

High energy electron flux is Active, probably then remaining above for the next four days, with slightly reduced confidence by 01 April with any further geomagnetic activity from a second - minor - coronal hole and possibly an Earth-directed CME which is currently yet to be analysed.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 1: Solar Synoptic Map valid 29/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Geomagnetic Storms

There are no definitively Earth-directed CMEs in the forecast at present. An eruption from 25 March may give a slight chance of a glance on 30 March as indicated by the latest MOSWOC Enlil ensemble forecast, although this is low confidence, and a miss is more likely. Imagery was limited for the CME related to the X1.1 flare on 28/1520 UTC, off the eastern limb in the vicinity of AR4046. The bulk of the ejecta appears to head east behind the Earths orbit, but some shock potentially could have an Earth-directed component. There is a the potential for an Earth-directed CME, from the centre disc close to AR4043, pending imagery being available for analysis. The most recent CME, on the southeast disc close to AR4048, is likely the CME will pass behind Earth's orbit.

The current CH25/+ HSS is waning but may connect with CH26/+ and possibly the fragmentary positive polarity coronal hole near the solar meridian at present. Although any resurgence from these feature would likely be very small. MOSWOC Enlil output is considered to be providing good guidance on the whole in indicating a gradual declining trend in the wind speed. The slight increase into 01 April is perhaps then related to the aforementioned minor unnumbered coronal hole. Overall, MOSWOC Enlil follows a similar trend to the previous rotation as regards the larger persistent CH feature. Solar winds are currently Slightly Elevated levels and are expected to continue, with a minor increase in the chances of G1 into the new calendar month - should the smaller coronal hole then manifest.

Overall, Quiet to Unsettled geomagnetic activity is most likely as connection to CH25/+ eases, with isolated Active intervals should Bz turn negative for a sustained period.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

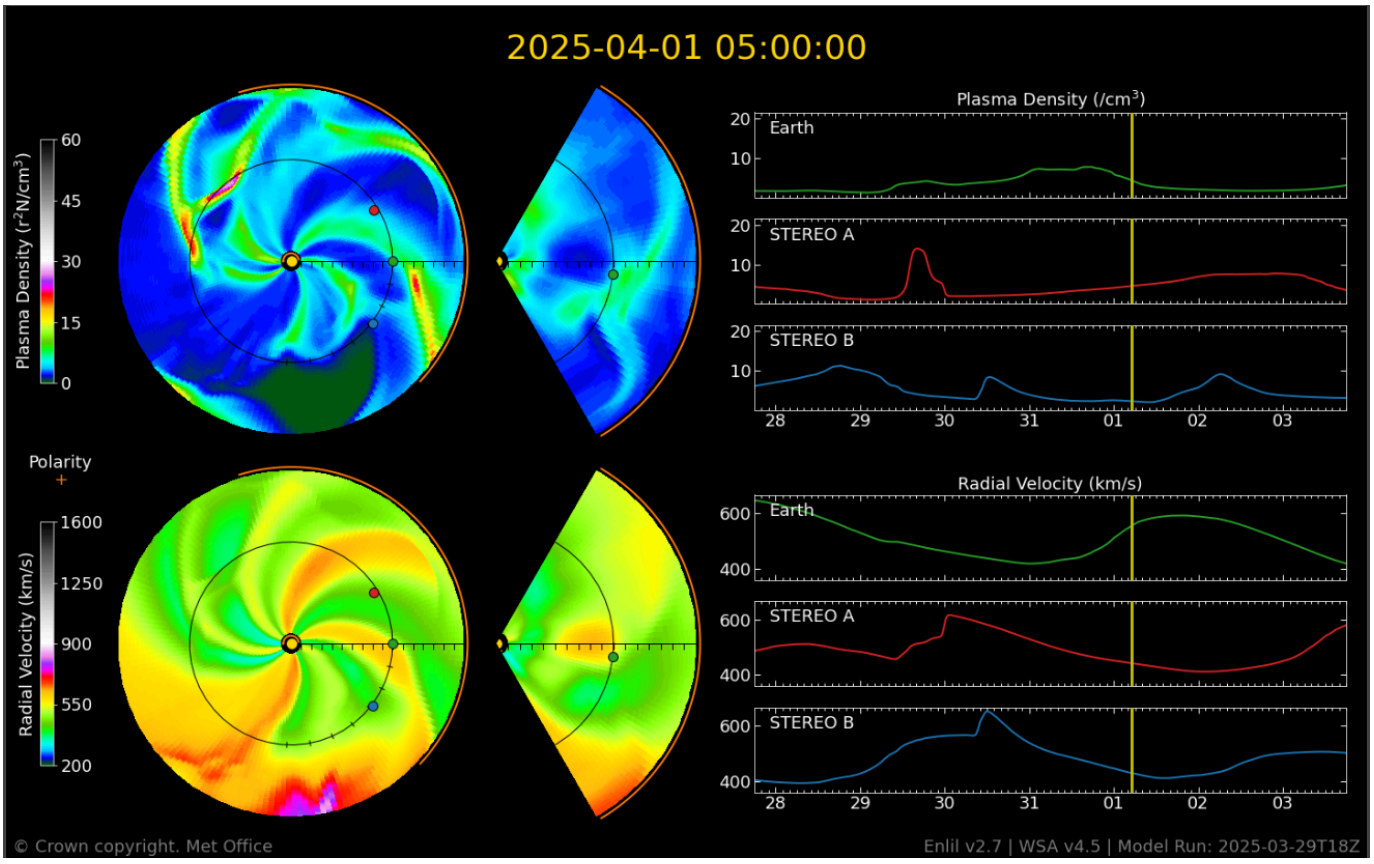
Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
25/1741 UTC	Partial	Filament eruption	SE	1300 km/s	29/1800 UTC	Low confidence as modelled on limited availability of imagery.

Figure 2: MOSWOC Enlil, currently doing a reasonable job showing the decline in solar winds following connection to CH25.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Radio Blackouts - X-Ray Flares

Solar activity is Moderate in the past 24 hours, with a M1.4 at 29/2138 UTC and M1.9 at 29/2259 UTC . The first M-class flare may have generated a CME, from the centre disc close to AR4043, pending imagery being available for analysis. The second M-class flare also appears to be related to a CME on the southeast disc close to AR4048, due to its location it is likely the CME will pass behind Earth's orbit.

There are up to six regions on the current disc. The newly numbered AR4048 on the southeast limb, appears to be a larger spot region. This region may have some complexity to it once fully visible on the disc. There is a large amount of magnetic looping and the region has been associated with a previous X-class flare and the latest M-class flare of which a CME may be associated. Most regions have developed during this period but remain magnetically simple. Most notable active regions are AR4046 with continued leading spot development and AR4043 with growth of trailing spots.

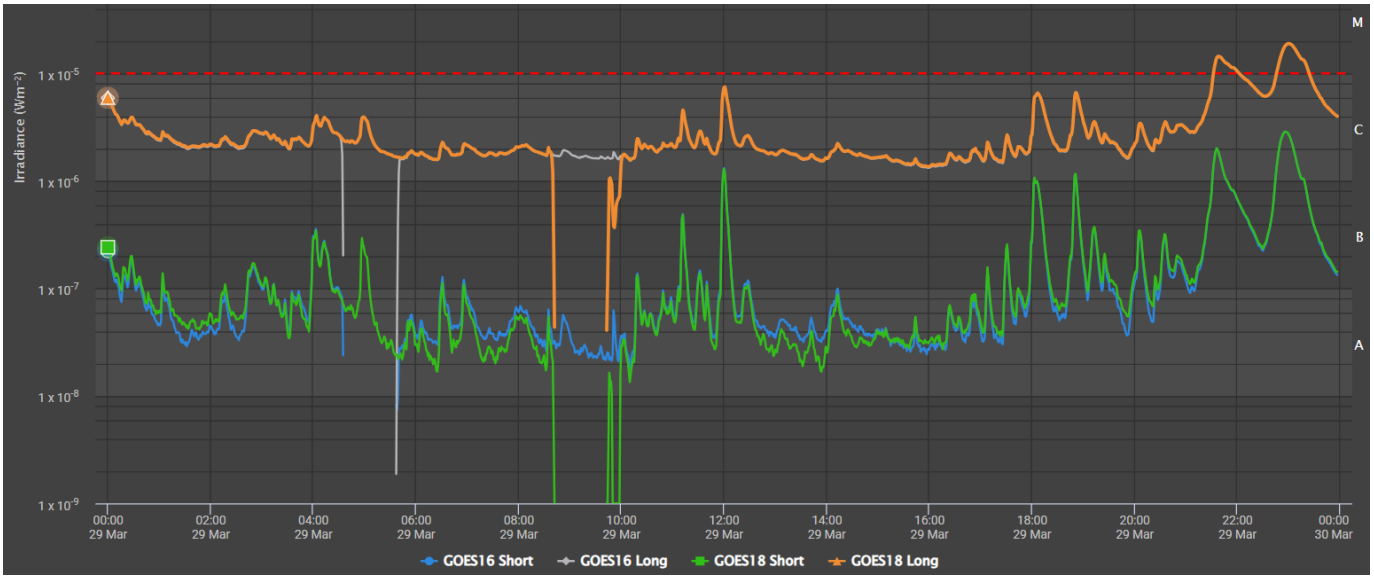
All considered, no significant regions depart in the four days, and the oncoming regions are perhaps already present, leading to a level trend. Due to some increase in complexity of active regions on the current disc, M-class activity has been raised slightly throughout relative to the visible regions' raw flare risk values. X-class activity has been lowered slightly due to the lack of activity in the period.

X-Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 (M Class)	Yes	60	60	60	60
Very Active	R3-R5 (X Class)	No	10	10	10	10

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 3: GOES-16 & -18 X-ray flux



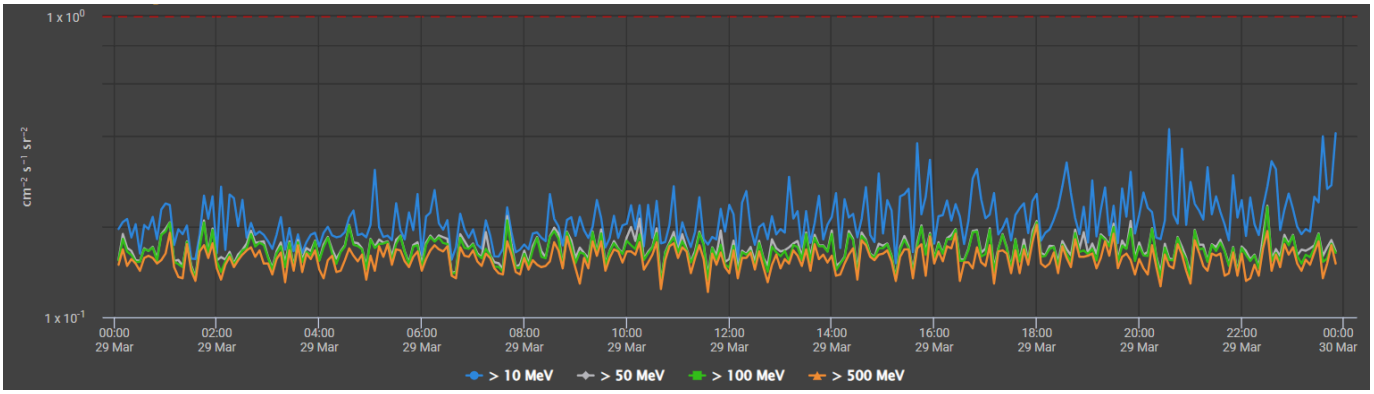
© Crown Copyright 2025. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

GOES18 high energy (>10MeV) proton flux was at Background levels. Given the dearth of western solar hemisphere sunspot regions, the daily risks of S1 or greater remain low, however the chances do gradually increase in the period with the westward advance of the far eastern groups.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES-18 Proton flux



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

High Energy Electrons (≥ 2MeV)

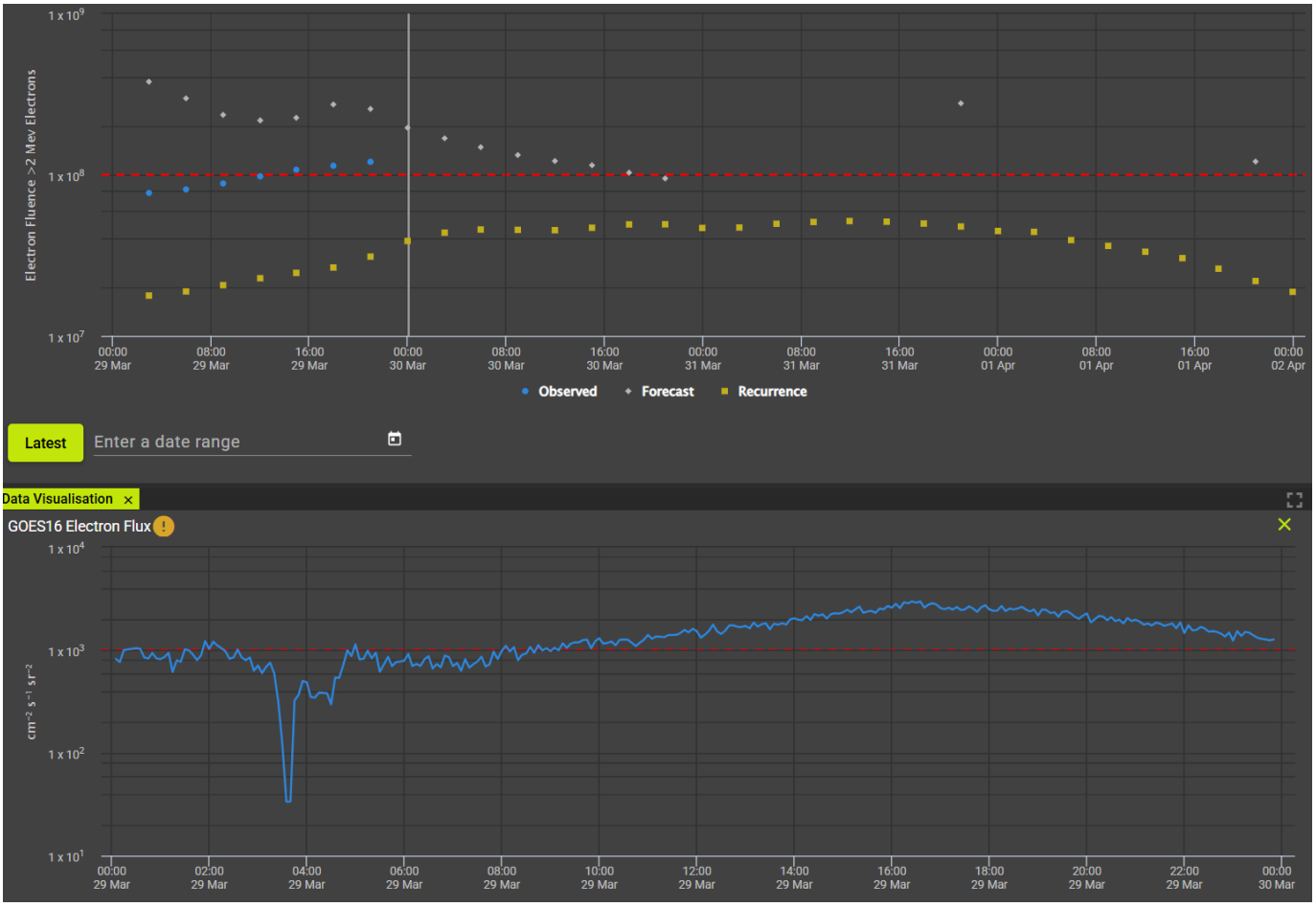
High energy electron flux (greater than 2 MeV) exceeded Active 24-hour integrated fluence at 29/1500 UTC in the wake of CH25/+ HSS. Geomagnetic activity is due to decline for day 1 and day 2 (30 and 31 Mar). There is a chance of an Earth-directed CME released in the vicinity of AR4043 at 28/2339 UTC but imagery is currently not available to analyse this feature. This increases the uncertainty in the outlook slightly. MOSWOC Enlil suggests a minor fast wind may feature on 01 April, which may provide a minor rise in geomagnetic activity to make the continuation of Active fluence into the new month slightly less certain.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	Yes	100	90	90	50
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2025. All Rights Reserved.

Figure 5: MOSWOC REFM, showing a rising trend in electron fluence following recent CH connection and GOES-16 Electron flux



© Crown Copyright 2025. All Rights Reserved.